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# 1981

# AIR MONITORING REPORT

# EDMONTON METROPOLITAN AREA

Alberta
ENVIRONMENT

87-03371/

1981

# AIR MONITORING REPORT
# EDMONTON METROPOLITAN AREA

prepared by

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POLLUTION CONTROL DIVISION

ENVIRONMENTAL PROTECTION SERVICES

ALBERTA ENVIRONMENT

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## SYNOPSIS

This report is an assessment of the ambient air quality in the Edmonton metropolitan area for the 1981 report year. The assessment is based on the results of the monitoring of various air pollutants by the Air Quality Control Branch of the Pollution Control Division of Alberta Environment from January 1, 1981 to December 31, 1981.

The emphasis is on comparing the data with the levels outlined in the Alberta Clean Air (Maximum Levels) Regulations and on assessing the data for trends.

The air quality indices--numerical indicators of air quality, which are based on readings of sulphur dioxide, ozone, carbon monoxide, suspended particulate matter, and nitrogen dioxide--are also discussed in this report. Generally, the air quality was in the 'good' index range.

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# I. INTRODUCTION

The Air Quality Control Branch of Alberta Environment operates an on-going program of ambient air monitoring in the Edmonton metropolitan area. The objectives of this program are twofold: to provide data for the assessment of existing air quality; and to establish long-term trends in air quality. To achieve these goals, the Branch operates a comprehensive network of stations equipped to measure oxides of nitrogen, ozone, carbon monoxide, sulphur dioxide, total hydrocarbons, particulates and total sulphation.

The report summarizes the results of the monitoring of these air pollutants from January 1, 1981 to December 31, 1981.

The data obtained during this report year are compared with the air quality Regulations, which stipulate the maximum permissible concentrations of contaminants in the ambient air. The "maximum permissible concentrations" are listed in the Alberta Clean Air (Maximum Levels) Regulations.

The "Source and Emission Inventories" for the pollutants are also cited to provide information on the contribution of each major source (e.g. industry and motor vehicles) to the total emissions of each pollutant.

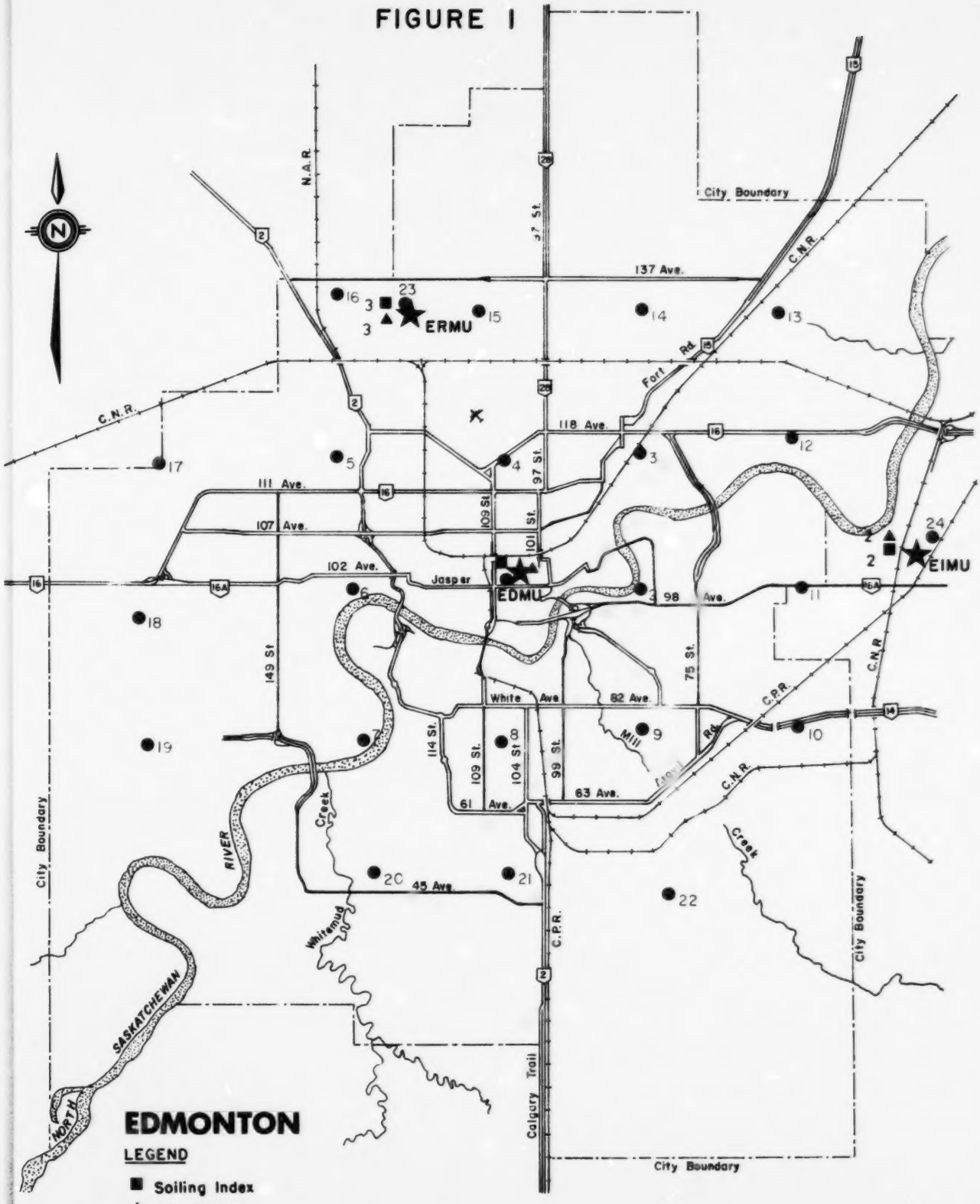
## II. THE AIR MONITORING NETWORK

The network of air monitoring stations in the Edmonton metropolitan area is comprised of two units: the continuous ambient air monitoring network, which collects data on oxides of nitrogen, ozone, carbon monoxide, sulphur dioxide and total hydrocarbons; and the static and intermittent air monitoring network, which samples total sulphation and particulates - soiling index, suspended particulate matter (high volume sampler) and total dustfall.

Figure 1 illustrates the locations of the three continuous air monitoring stations. The stations are designated EDMU, ERMU and EIMU. The designations refer to the general locations of the stations in the downtown, residential and industrial areas respectively. Table 1 lists the parameters that each station is equipped to monitor continuously and gives additional information about the stations.

The locations of the static and intermittent air monitoring stations are also shown in Figure 1. This network of stations is comprised of 24 exposure sites for measuring total sulphation and total dustfall and three sites for measuring soiling index and suspended particulate matter.

# FIGURE 1




## EDMONTON

LEGEND

- ■ Soiling Index
- ▲ Hi - Volume
- ● Exposure Cylinders
- ★ Continuous Monitors

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TABLE 1

THE CONTINUOUS AMBIENT AIR MONITORING NETWORK

Parameters that Stations are Equipped to Monitor Continuously

| Station | Wind | $NO_x$ | $NO_2$ | $O_3$ | CO | $SO_2$ | THC |
|---|---|---|---|---|---|---|---|
| EDMU | - | X | X | X | X | - | X |
| EIMU | X | X | X | X | X | X | X |
| ERMU | X | X | X | X | X | - | X |

Note: EDMU - Edmonton Downtown Monitoring Unit
EIMU - Edmonton Industrial Monitoring Unit
ERMU - Edmonton Residential Monitoring Unit

$NO_x$ - Oxides of Nitrogen
$NO_2$ - Nitrogen Dioxide
$O_3$ - Ozone
CO - Carbon Monoxide
$SO_2$ - Sulphur Dioxide
THC - Total Hydrocarbons

Station Documentation

| Station | Station Address | Height of Station | Height of Sample Inlet Above Ground |
|---|---|---|---|
| EDMU | 104 St. and 103 Ave. | 5.5 m | 8.5 m |
| EIMU | 17 St. and 105 Ave. | 2.5 m | 5.0 m |
| ERMU | 127 St. and 133 Ave. | 2.5 m | 3.5 m |

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## III. THE AIR MONITORING INSTRUMENTATION

The detection principles and sampling periods of the pollutants monitored during the 1981 report year are presented in Table 2. Also included are the methods used to calibrate the instruments and the type of monitoring that was employed for each pollutant.

There are three basic types of ambient air monitoring, and they differ on the basis of the duration of the sampling periods: continuous, static and intermittent. Continuous monitoring is the sampling of the air on a continuous basis; static monitoring involves time periods of approximately 30 days; and intermittent monitoring encompasses 1-hour, 2-hour and 24-hour sampling time periods.

Monitoring of ambient air may also be categorized according to the method used for analyzing the sample, automatic or manual. Automatic analysis is accomplished by a system which has the capability of collecting the sample, analyzing it and giving a data read-out. This is exemplified by the monitoring of oxides of nitrogen, ozone, carbon monoxide, sulphur dioxide and total hydrocarbons. Manual analysis involves the collection of a sample and subsequent analysis at a laboratory. The monitoring of particulates and total sulphation are examples of the manual method.

TABLE 2

THE AIR MONITORING INSTRUMENTATION

| Pollutant | Detection Principle | Sampling Period | Type of Monitoring | Instrument Calibration Method |
|---|---|---|---|---|
| Nitrogen Dioxide | Chemiluminescence | Instantaneous (sample integration) | Continuous | Permeation tube or Gas Phase titration |
| Ozone | Chemiluminescence or Ultraviolet photometry | Instantaneous (sample integration) | Continuous | Buffered potassium iodide or Gas phase titration |
| Carbon Monoxide | Nondispersive infrared radiation | Instantaneous (sample integration) | Continuous | Certified gas cylinder |
| Sulphur Dioxide | Coulometric detection or Pulsed fluorescence | Instantaneous (sample integration) | Continuous | Permeation tube |
| Total Hydrocarbons | Flame ionization | Instantaneous (sample integration) | Continuous | Certified gas cylinder |
| Suspended Particulate Matter (Soiling Index) | Tape sampler (light transmittance) | 1-hour or 2-hour | Intermittent | Rotameter - flow |
| Suspended Particulate Matter (High-Volume Sampler) | Gravimetry | 24-hour | Intermittent | Orifice plates/mass flow detection |
| Total Sulphation | Chemical reaction | 30 days | Static | N/A |
| Total Dustfall | Gravimetry | 30 days | Static | N/A |



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# IV. AIR POLLUTANT DATA ANALYSES

## A. INTRODUCTION

In this section of the report, the pollutants are examined on an individual basis. The presentation includes general information on the pollutants, an overview of the prime emission sources as determined by the 1973 Source and Emission Inventory and an analysis of the data.

For the purposes of this report, the data are summarized. The summaries include arithmetic mean concentrations and the frequency of occurrence of concentrations in compliance with the Clean Air (Maximum Levels) Regulations.

Sufficient data must be available to constitute valid calculated mean values. When the instrument operational time is less than 50%, no arithmetic mean is calculated; and when the instrument is operational between 50% and 75% of the time, the arithmetic mean may not be representative of that period. Therefore, any comparisons of the data should take this into account.

Tables 3 and 4 are included to provide an overall picture of existing air quality and to give some idea of the trends of the air pollution levels over the past five years. Starting with the 1982 annual report, a detailed trend analysis section will be included.

TABLE 3

POLLUTANTS COMPARED WITH REGULATIONS[1]

1981

| POLLUTANT | PERCENT COMPLIANCE WITH REGULATIONS[1] | | | AIR QUALITY REGULATIONS |
|---|---|---|---|---|
| | EDMU | EIMU | ERMU | |
| Nitrogen Dioxide | | | | |
| 1-hour | 99.99 | 100 | 100 | 0.21 ppm |
| 24-hour | 100 | 100 | 100 | 0.11 ppm |
| Ozone | | | | |
| 1-hour | 99.98 | 99.92 | 99.59 | 0.080 ppm |
| 24-hour | 92.82 | 63.50 | 71.50 | 0.025 ppm |
| Carbon Monoxide | | | | |
| 1-hour | 99.78 | 100 | 99.51 | 13.0 ppm |
| 8-hour | 95.87 | 100 | 95.18 | 5.0 ppm |
| Sulphur Dioxide | | | | |
| 1-hour | 100 | 100 | 100 | 0.17 ppm |
| 24-hour | 100 | 100 | 100 | 0.06 ppm |
| Suspended Particulate Matter (Soiling Index-COH) | 91.42 | 100 | 100 | A minimum of 90% of readings per month shall be less than 1.0 COH. |
| Suspended Particulate Matter (High-Volume Sampler) | 47.45 | 78.33 | 88.33 | 100 $\mu g/m^3$/24hr |
| Total Dustfall[2] | | | | |
| Residential and Recreational Area Stations | | 48.28 | | 53 mg/100 $cm^2$/30 days |
| Commercial and Industrial Area Stations | | 71.57 | | 158 mg/100 $cm^2$/30 days |

[1] Clean Air (Maximum Levels) Regulations.
[2] No allowance made for normal background levels as required by (1).

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TABLE 4

ANNUAL CONCENTRATION MEANS IN EDMONTON*
(1977-1981)

| | | 1977 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|---|
| Nitrogen Dioxide | EDMU | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| (ppm) | EIMU | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| | ERMU | 0.02 | 0.03 | 0.03 | 0.02 | 0.03 |
| Ozone | EDMU | 0.014 | 0.009 | 0.012 | 0.012 | 0.012 |
| (ppm) | EIMU | 0.015 | 0.017 | 0.023 | 0.019 | 0.021 |
| | ERMU | 0.015 | 0.017 | 0.019 | 0.015 | 0.018 |
| Carbon Monoxide | EDMU | 2.1 | 2.2 | 3.3 | 2.8 | 2.2 |
| (ppm) | EIMU | 0.3 | 0.4 | 0.4 | 0.8 | 1.0 |
| | ERMU | 1.5 | 1.3 | 1.9 | 1.9 | 1.6 |
| Total Hydrocarbons | | | | | | |
| (ppm) | EDMU | 2.0 | 2.2 | 1.8 | 2.1 | 2.2 |
| | EIMU | 2.6 | 3.6 | 2.5 | 2.5 | 2.8 |
| | ERMU | 2.1 | 2.4 | 2.6 | 2.5 | 2.5 |
| Total Sulphation 24 Stations ($SO_3$ equiv. mg/100cm$^2$/day) | | 0.13 | 0.11 | 0.10 | 0.16 | 0.15 |
| Suspended Particulate Matter | | | | | | |
| Soiling Index | EDMU | 0.19 | 0.20 | 0.27 | 0.32 | 0.37 |
| (COH Units) | EIMU | 0.10 | 0.14 | 0.21 | 0.23 | 0.22 |
| | ERMU | 0.09 | 0.17 | 0.25 | 0.29 | 0.29 |
| Suspended Particulate Matter High-Volume Sampler | EDMU | 93 | 83 | 102 | 104 | 103 |
| µg/m$^3$ | EIMU | 60 | 66 | 77 | 72 | 66 |
| (Geometric Mean) | ERMU | 62 | 66 | 92 | 81 | 64 |
| Total Dustfall | | | | | | |
| Residential and Recreational Area Stations (15) mg/100 cm$^2$/30 days | | 52 | 49 | 51 | 65 | 68 |
| Commercial and Industrial Area Stations (9) mg/100 cm$^2$/30 days | | 94 | 102 | 140 | 125 | 142 |

*For years 1977-1980 inclusive, means are based on climatic year (March of one year to February of the next year); 1981 means are based on the calendar year.

B. OXIDES OF NITROGEN ($NO_x$)

Oxides of nitrogen are composed of two major constituents: nitrogen dioxide ($NO_2$) and the less toxic nitric oxide (NO). Both pollutants originate from natural and man-made processes. Nitrogen and oxygen, the principle constituents of the atmosphere, combine during high temperature combustion to form $NO_x$.[1] The major man-made source is from the burning of fossil fuels such as natural gas, coal, oil and gasoline.

In the Edmonton metropolitan area, motor vehicles contribute about half of the oxides of nitrogen emissions, electric power generation contributes about 30 percent, and natural gas combustion from sources such as home heating contributes 15 percent (Figure 2 - "Source and Emission Inventory").

The major oxide of nitrogen at the point of combustion is nitric oxide. A small fraction of the nitric oxide is converted to nitrogen dioxide by photochemical oxidation. Since it has been demonstrated that nitrogen dioxide can cause deleterious effects, and is the more toxic oxide of nitrogen, the emphasis here will be placed on nitrogen dioxide.

Nitrogen dioxide is an orange-brown gas with a characteristic pungent odour. Because of its colouration, it has been postulated that $NO_2$ is responsible for a portion of the brownish discolouration of air masses near urban areas.

The results of the monitoring of $NO_2$ during the 1981 report period are presented in Table 5 and Figure 2. All the monitored levels were below the stipulated maximum permissible concentrations of $NO_2$ in the ambient air, with the exception of 99.8% compliance with the 1-hour Regulation at EDMU in January. Vehicular traffic exhaust is responsible for the small amount of non-compliance time.

TABLE 5
NITROGEN DIOXIDE/OXIDES OF NITROGEN

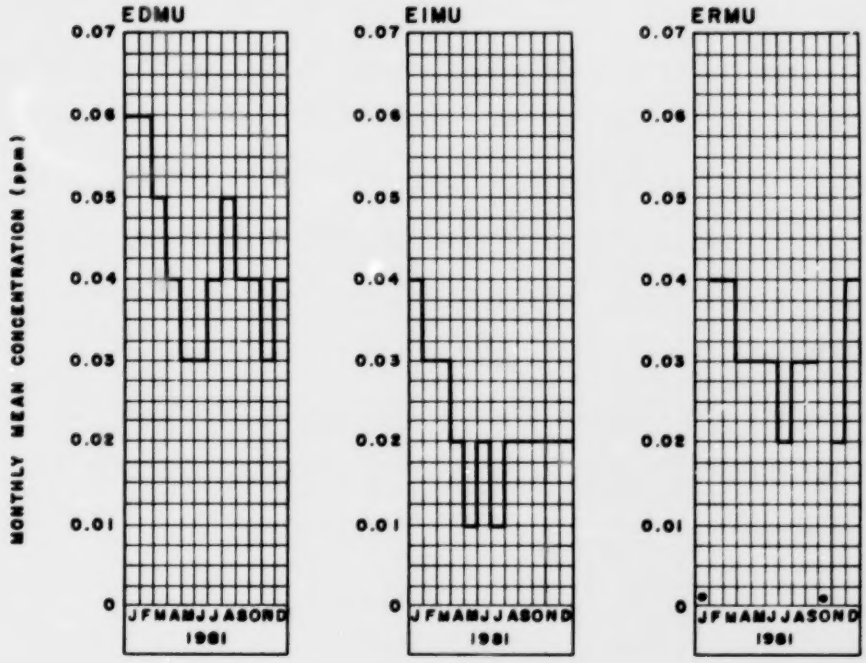
MAXIMUM LEVELS REGULATIONS($NO_2$)
1-HOUR-0.21 PPM 24-HOUR-0.11 PPM

| MONTH | ARITHMETIC MEAN (ppm) | | PERCENTAGE OF TIME INSTRUMENT OPERATIONAL | | PERCENT COMPLIANCE WITH $NO_2$ REGULATIONS | |
|---|---|---|---|---|---|---|
| | $NO_2$ | $NO_x$ | $NO_2$ | $NO_x$ | 1-HR. | 24-HR. |
| **EDMU** | | | | | | |
| January '81 | 0.06 | 0.16 | 89.0 | 89.0 | 99.8 | 100 |
| February | 0.06 | 0.12 | 92.9 | 92.9 | 100 | 100 |
| March | 0.05 | 0.09 | 95.7 | 95.7 | 100 | 100 |
| April | 0.04 | 0.07 | 96.7 | 96.7 | 100 | 100 |
| May | 0.03 | 0.06 | 96.6 | 96.6 | 100 | 100 |
| June | 0.03 | 0.07 | 98.2 | 98.2 | 100 | 100 |
| July | 0.04 | 0.08 | 96.2 | 96.2 | 100 | 100 |
| August | 0.05 | 0.09 | 96.5 | 96.5 | 100 | 100 |
| September | 0.04 | 0.08 | 96.7 | 96.7 | 100 | 100 |
| October | 0.04 | 0.09 | 93.8 | 93.8 | 100 | 100 |
| November | 0.03 | 0.12 | 97.4 | 97.4 | 100 | 100 |
| December | 0.04 | 0.13 | 97.4 | 97.4 | 100 | 100 |
| **EIMU** | | | | | | |
| January '81 | 0.04 | 0.08 | 96.8 | 96.8 | 100 | 100 |
| February | 0.03 | 0.06 | 96.4 | 96.4 | 100 | 100 |
| March | 0.03 | 0.05 | 95.0 | 95.0 | 100 | 100 |
| April | 0.02 | 0.03 | 95.7 | 95.7 | 100 | 100 |
| May | 0.01 | 0.02 | 95.6 | 95.6 | 100 | 100 |
| June | 0.02 | 0.02 | 90.8 | 90.8 | 100 | 100 |
| July | 0.01 | 0.02 | 89.2 | 89.7 | 100 | 100 |
| August | 0.02 | 0.03 | 88.3 | 88.3 | 100 | 100 |
| September | 0.02 | 0.04 | 96.3 | 96.3 | 100 | 100 |
| October | 0.02 | 0.04 | 95.7 | 95.7 | 100 | 100 |
| November | 0.02 | 0.05 | 96.9 | 96.9 | 100 | 100 |
| December | 0.02 | 0.06 | 96.8 | 96.8 | 100 | 100 |
| **ERMU** | | | | | | |
| January '81 | a. | a. | 36.2 | 36.2 | 100 | 100 |
| February | 0.04 | 0.09 | 75.0 | 75.0 | 100 | 100 |
| March | 0.04 | 0.09 | 95.6 | 95.6 | 100 | 100 |
| April | 0.03 | 0.05 | 95.3 | 95.3 | 100 | 100 |
| May | 0.03 | 0.04 | 91.5 | 91.5 | 100 | 100 |
| June | 0.03 | 0.04 | 96.8 | 96.8 | 100 | 100 |
| July | 0.02 | 0.04 | 95.7 | 96.0 | 100 | 100 |
| August | 0.03 | 0.05 | 97.7 | 97.7 | 100 | 100 |
| September | 0.03 | 0.08 | 90.7 | 90.7 | 100 | 100 |
| October | b. | b. | b. | b. | b. | b. |
| November | 0.02 | 0.10 | 94.0 | 94.2 | 100 | 100 |
| December | 0.04 | 0.11 | 96.4 | 96.4 | 100 | 100 |

a.-Instrument operational less than 50%; insufficient data for calculation of mean.
b.-No data due to instrument malfunction.

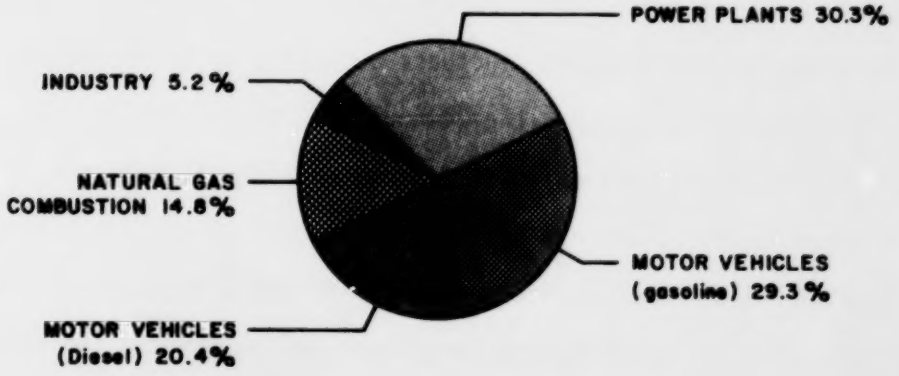
# FIGURE 2 - OXIDES OF NITROGEN

## $NO_2$ MONTHLY MEANS




• INSUFFICIENT DATA FOR CALCULATION OF MEAN.

## SOURCE AND EMISSION INVENTORY




RELATIVE CONTRIBUTION OF EACH CATEGORY TO TOTAL OXIDES OF NITROGEN EMISSIONS IN THE EDMONTON AREA, 1973

OXIDES OF NITROGEN 19,973 TONS

Alberta ENVIRONMENT Pollution Control Division

C. OZONE ($O_3$)

Unlike many other pollutants, ozone is not introduced directly to the air by man's activities. In the upper atmosphere, ozone is a naturally occurring constituent; in the lower atmosphere or ambient air, ozone is the primary end-product of photochemical oxidation involving the nitrogen oxides, ultraviolet light energy and reactive hydrocarbons. Ozone plays an important role in the absorption of harmful ultraviolet radiation in the upper atmosphere; however, in ambient air it can be harmful to humans, vegetation and various materials.

Table 6 and Figure 3 present a summary of the ozone data collected for this report year. Several observations can be made: there was a frequent occurrence of readings in excess of the Clean Air (Maximum Levels) Regulations for a 24-hour period; ERMU and EIMU recorded higher levels than EDMU; and the ozone levels were highest during the spring and summer months at all three stations.

The high frequency of readings in excess of the 24-hour Regulation is attributable to the high natural levels of ozone in Alberta, constituting what is referred to as "background" levels. The background levels can fluctuate depending on environmental conditions and can exceed the 24-hour Regulation.[2]

The higher concentrations of ozone recorded at ERMU and EIMU, relative to EDMU, may not be indicative of local sources but may have resulted from wind transportation of the precursors to those areas. The elevated readings in spring and summer are indicative of the increase in ultraviolet light energy, which enhances the photochemical production of ozone.

TABLE 6
OZONE

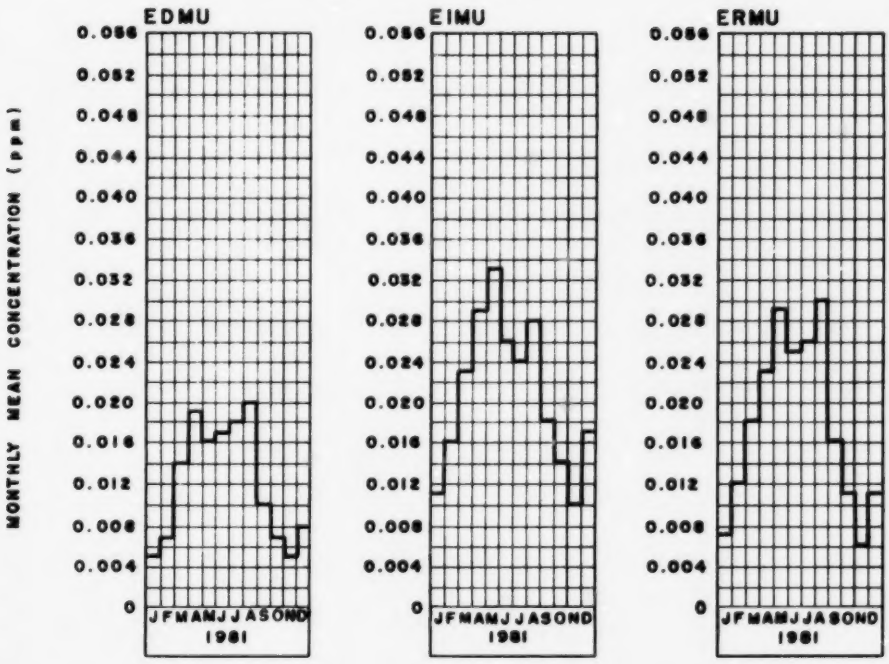
MAXIMUM LEVELS REGULATIONS
1-HOUR-0.080 PPM 24-HOUR-0.025 PPM

| MONTH | ARITHMETIC MEAN (ppm) | PERCENTAGE OF TIME INSTRUMENT OPERATIONAL | PERCENT COMPLIANCE WITH REGULATIONS | |
|---|---|---|---|---|
| | | | 1-HR | 24-HR |
| **EDMU** | | | | |
| January '81 | 0.005 | 89.7 | 100 | 100 |
| February | 0.007 | 95.1 | 100 | 100 |
| March | 0.014 | 95.7 | 100 | 100 |
| April | 0.019 | 95.7 | 100 | 79.1 |
| May | 0.016 | 95.0 | 100 | 89.8 |
| June | 0.017 | 97.4 | 100 | 100 |
| July | 0.018 | 94.9 | 100 | 79.6 |
| August | 0.020 | 98.7 | 99.7 | 67.3 |
| September | 0.010 | 96.0 | 100 | 100 |
| October | 0.007 | 94.8 | 100 | 100 |
| November | 0.005 | 95.8 | 100 | 100 |
| December | 0.008 | 95.8 | 100 | 100 |
| **EIMU** | | | | |
| January '81 | 0.011 | 95.7 | 100 | 96.6 |
| February | 0.016 | 95.5 | 100 | 92.5 |
| March | 0.023 | 95.0 | 100 | 62.7 |
| April | 0.029 | 94.9 | 100 | 22.7 |
| May | 0.033 | 95.2 | 100 | 0.0 |
| June | 0.026 | 95.3 | 100 | 40.5 |
| July | 0.024 | 90.7 | 99.9 | 64.4 |
| August | 0.028 | 93.3 | 99.1 | 41.2 |
| September | 0.018 | 95.6 | 100 | 79.1 |
| October | 0.014 | 94.9 | 100 | 93.2 |
| November | 0.010 | 95.4 | 100 | 100 |
| December | 0.017 | 95.4 | 100 | 73.0 |
| **ERMU** | | | | |
| January '81 | 0.007 | 96.4 | 100 | 100 |
| February | 0.012 | 96.1 | 100 | 88.2 |
| March | 0.018[a] | 66.0 | 100 | 85.3 |
| April | 0.023 | 93.9 | 100 | 64.5 |
| May | 0.029 | 91.5 | 100 | 22.5 |
| June | 0.025 | 95.4 | 100 | 37.1 |
| July | 0.026 | 94.9 | 99.2 | 45.6 |
| August | 0.030 | 95.4 | 96.8 | 39.2 |
| September | 0.016 | 95.6 | 99.4 | 93.0 |
| October | 0.011 | 96.0 | 100 | 100 |
| November | 0.006 | 94.7 | 100 | 100 |
| December | 0.011 | 95.7 | 100 | 89.9 |

a.-Instrument operational less than 75%; monthly mean may not be representative.

# FIGURE 3 - OZONE

## MONTHLY MEANS




## SOURCE AND EMISSION INVENTORY

SINCE OZONE IS PRIMARILY A PRODUCT OF PHOTOCHEMICAL REACTION, THE SOURCE AND EMISSION INVENTORY IS NOT APPLICABLE.

D. CARBON MONOXIDE (CO)

Carbon monoxide is an odourless, colourless gas. It is emitted into the atmosphere in greater quantities than any other urban air pollutant. The majority of the carbon monoxide found in urban air comes from man-made sources. Natural sources, such as forest fires and plant decay, maintain a very low background level.

The 1973 "Source and Emission Inventory" for the Edmonton metropolitan area (Figure 4) indicates that industry is the major source of CO, with motor vehicles being the second largest contributor. However, with the increase in vehicular traffic over the years, the contribution of the motor vehicle to the total CO emissions may have surpassed that contributed by industry.

There were averages of 99.8% compliance and 97.0% compliance respectively with the 1-hour and the 8-hour carbon monoxide Regulations, averaged for all three monitoring stations for the report year. Vehicular traffic exhaust is responsible for the small amount of non-compliance time.

The higher carbon monoxide levels monitored at EDMU and ERMU, relative to EIMU, (Table 7 and Figure 4) are indicative of the vehicular traffic density in the downtown and residential areas respectively. Diurnal variations of CO levels indicate that peak levels occur during or immediately following peak rush hour periods. The data also indicate that the lowest CO concentrations were monitored during the spring and summer seasons at all three stations. This seasonal variation of CO levels results from changes in meteorological parameters. In the fall and winter, the colder ambient temperatures result in increased production of CO emissions from motor vehicles. In addition, the more stable atmospheric

conditions and low wind speeds which occur during the fall and winter result in decreased dispersion of CO emissions and consequently higher ground level CO concentrations, relative to spring and summer concentrations.

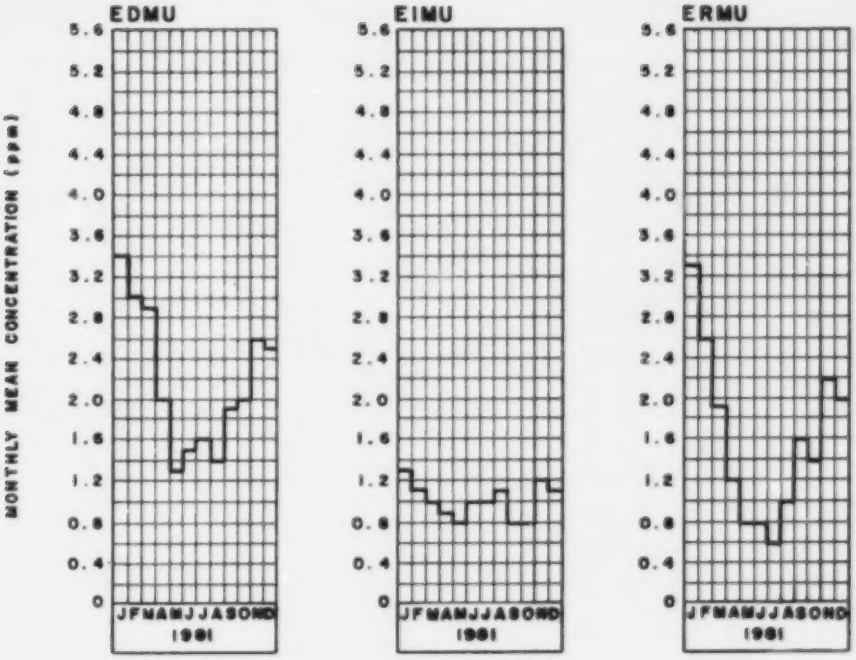
TABLE 7
CARBON MONOXIDE

MAXIMUM LEVELS REGULATIONS
1-HOUR-13 PPM 8-HOUR-5 PPM

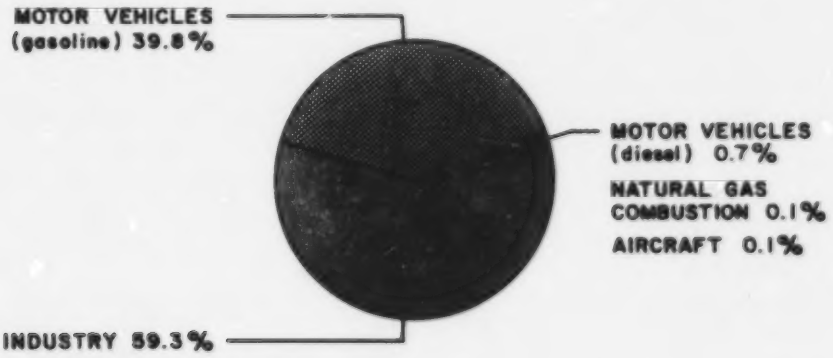
| MONTH | ARITHMETIC MEAN (ppm) | PERCENTAGE OF TIME INSTRUMENT OPERATIONAL | PERCENT COMPLIANCE WITH REGULATIONS | |
|---|---|---|---|---|
| | | | 1-HR | 8-HR |
| **EDMU** | | | | |
| January '81 | 3.4 | 91.4 | 98.2 | 84.7 |
| February | 3.0 | 97.0 | 100 | 90.2 |
| March | 2.9 | 97.3 | 99.7 | 94.5 |
| April | 2.0 | 97.4 | 100 | 98.9 |
| May | 1.3 | 97.4 | 100 | 100 |
| June | 1.5 | 98.3 | 100 | 100 |
| July | 1.6 | 96.2 | 100 | 100 |
| August | 1.4 | 99.2 | 100 | 100 |
| September | 1.9 | 97.4 | 100 | 100 |
| October | 2.0 | 96.4 | 99.9 | 96.7 |
| November | 2.6 | 97.2 | 99.6 | 94.3 |
| December | 2.5 | 97.4 | 99.9 | 90.1 |
| **EIMU** | | | | |
| January '81 | 1.3 | 97.4 | 100 | 100 |
| February | 1.1 | 97.2 | 100 | 100 |
| March | 1.0 | 97.0 | 100 | 100 |
| April | 0.9 | 96.8 | 100 | 100 |
| May | 0.8 | 97.2 | 100 | 100 |
| June | 1.0 | 97.2 | 100 | 100 |
| July | 1.0 | 93.4 | 100 | 100 |
| August | 1.1 | 87.0 | 100 | 100 |
| September | 0.8 | 97.1 | 100 | 100 |
| October | 0.8 | 97.0 | 100 | 100 |
| November | 1.2 | 97.1 | 100 | 100 |
| December | 1.1 | 97.0 | 100 | 100 |
| **ERMU** | | | | |
| January '81 | 3.3 | 97.8 | 97.7 | 79.1 |
| February | 2.6 | 95.7 | 99.1 | 88.8 |
| March | 1.9 | 96.4 | 99.6 | 96.7 |
| April | 1.2 | 96.9 | 100 | 100 |
| May | 0.8 | 96.6 | 100 | 100 |
| June | 0.8 | 96.7 | 100 | 100 |
| July | 0.6 | 97.3 | 100 | 100 |
| August | 1.0 | 97.6 | 100 | 100 |
| September | 1.6 | 97.2 | 99.4 | 95.4 |
| October | 1.4 | 91.5 | 100 | 97.7 |
| November | 2.2 | 96.9 | 98.7 | 92.0 |
| December | 2.0 | 97.4 | 99.7 | 92.3 |

# FIGURE 4 - CARBON MONOXIDE

## MONTHLY MEANS




## SOURCE AND EMISSION INVENTORY




RELATIVE CONTRIBUTION OF EACH CATEGORY TO TOTAL CARBON MONOXIDE EMISSIONS IN THE EDMONTON AREA, 1973

CARBON MONOXIDE
379,200 TONS

E. SULPHUR DIOXIDE ($SO_2$)

Sulphur dioxide constitutes one of the major air pollutants on a global basis. It may oxidize and combine with moisture to form sulphuric acid and, as such, increase its harmful effects on vegetation and the respiratory systems of humans and animals. When combined with particulate matter, it exerts a synergistic effect that is more harmful than the effect of either pollutant.

Sulphur dioxide pollution results primarily from man-made sources such as combustion of fossil fuels, smelting and roasting of sulphur containing ores, kraft and sulphite wood pulping and sour gas processing. In Alberta, an estimated 265 thousand metric tons of sulphur were emitted into the atmosphere from man-made (primarily industrial operations) sources during 1981. About 47 percent of the sulphur emissions was contributed by sulphur extraction plants; oil sands plants and power plants contributed about 27 percent and 13 percent respectively. The remaining 13 percent came from sources such as gas plant flares, oil refineries, pulp and paper mills and fertilizer plants.[3]

A summary of the sulphur dioxide data collected during the 1981 report period is presented in Table 8. All sulphur dioxide readings were well below the Regulations, resulting in 100% compliance.

Figure 5 illustrates the $SO_2$ "Source and Emission Inventory" for the Edmonton area and includes a graph of total sulphation levels. Although the total sulphation cylinders are static monitors and yield only monthly average values, the data do provide valuable trend information and, therefore, are included in this section.

$SO_2$ monitoring was discontinued at the downtown area station (EDMU) and at the residential area station (ERMU) in early March, 1981 due to the fact that no detectable readings had been obtained for a considerable length of time at either station.

The lowest total sulphation levels of the period occurred in September (0.03 mg. $SO_3$ equiv./day/100 sq. cm.), with the highest level of 0.25 mg. $SO_3$ equiv./day/100 sq. cm. occurring in October (Figure 5). All monthly mean concentration levels were below the 0.5 mg. $SO_3$ equiv./day/100 sq. cm. guideline (Figure 5).

TABLE 8
SULPHUR DIOXIDE

MAXIMUM LEVELS REGULATIONS
1-HOUR-0.17 PPM 24-HOUR-0.06 PPM

EIMU

| MONTH | ARITHMETIC MEAN (ppm) | PERCENTAGE OF TIME INSTRUMENT OPERATIONAL | PERCENT COMPLIANCE WITH REGULATIONS | |
|---|---|---|---|---|
| | | | 1-HR | 24-HR |
| January '81 | 0.00 | 96.0 | 100 | 100 |
| February | 0.00 | 95.8 | 100 | 100 |
| March | 0.00 | 91.0 | 100 | 100 |
| April | 0.00 | 90.4 | 100 | 100 |
| May | 0.00 | 94.0 | 100 | 100 |
| June | 0.00 | 95.3 | 100 | 100 |
| July | 0.00 | 80.2 | 100 | 100 |
| August | 0.00 | 90.3 | 100 | 100 |
| September | 0.00 | 93.1 | 100 | 100 |
| October | 0.00 | 94.1 | 100 | 100 |
| November | 0.00 | 95.4 | 100 | 100 |
| December | 0.00 | 95.2 | 100 | 100 |

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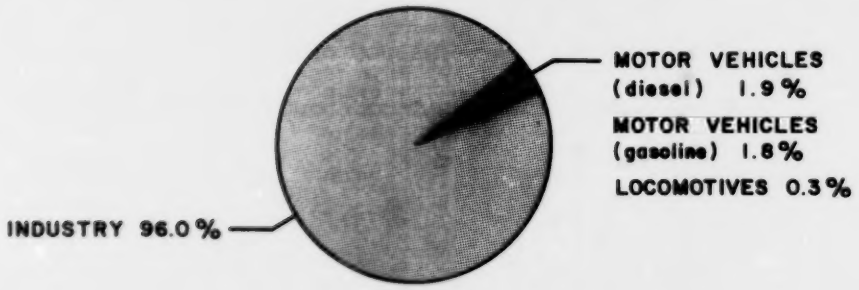
Pollution Control Division
Air Quality Control Branch

# FIGURE 5 - SULPHUR DIOXIDE

## NOTE

THE MONTHLY MEAN CONCENTRATIONS WERE 0.00 ppm THROUGHOUT THE REPORT YEAR AT EIMU.

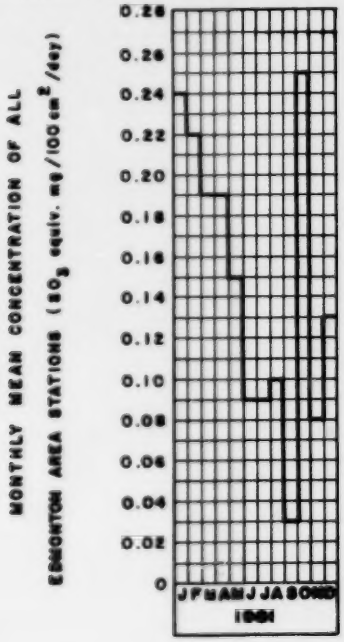
## SOURCE AND EMISSION INVENTORY




RELATIVE CONTRIBUTION OF EACH CATEGORY TO TOTAL SULPHUR DIOXIDE EMISSIONS IN THE EDMONTON AREA, 1973

SULPHUR DIOXIDE 15,591 TONS

## MONTHLY MEAN TOTAL SULPHATION LEVELS



F. TOTAL HYDROCARBONS (THC)

The hydrocarbons considered in this section are those which exist in the atmosphere in the gaseous phase. They are important because they are precursors of compounds formed in the atmospheric photochemical system. Therefore, any assessment of the effects of hydrocarbon pollution must be made in relation to the effects of photochemical air pollution.

The natural sources of the gas-phase hydrocarbons, of which methane is a major constituent, include trees and vegetation. For man-made sources, the "Source and Emission Inventory" (Figure 6) indicates that industry is the primary source, with motor vehicles being the second largest contributor. The industrial emissions originate primarily from hydrocarbon storage, whereas the motor vehicle emissions result from inefficient combustion. Inefficient combustion, which occurs before the vehicle reaches operating temperature, is particularly evident during the winter.

The levels of total hydrocarbons monitored during this report period (Table 9 and Figure 6) did not show any definitive trends on a seasonal basis. However, the lowest hourly average reading of the three stations occurred at the downtown station, EDMU, while the industrial station, EIMU, showed the highest hourly average reading of the three stations. EIMU is located in the vicinity of hydrocarbon storage and processing facilities, which explains why these higher hourly average readings were monitored throughout the report year.

Currently there are no air quality Regulations for hydrocarbons.

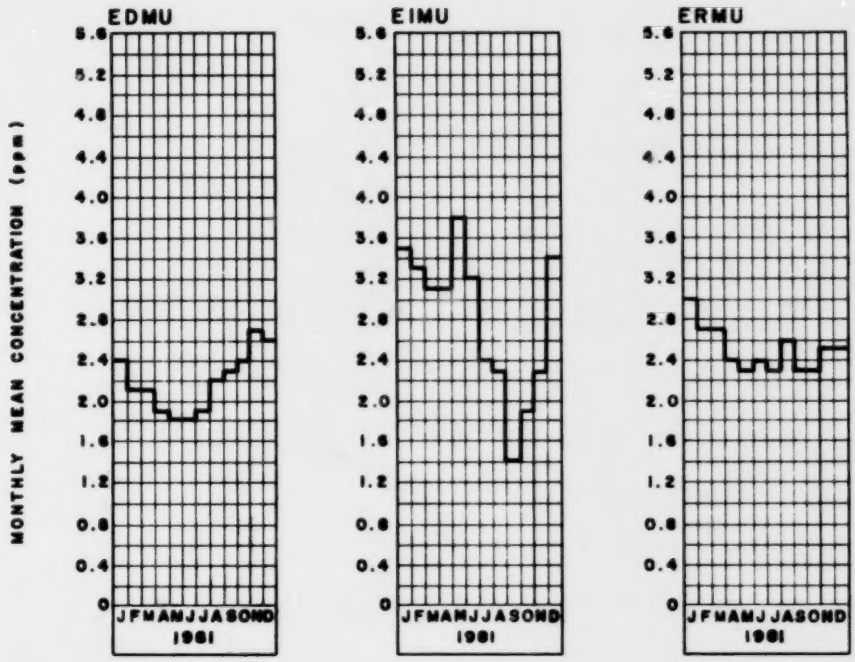
TABLE 9

TOTAL HYDROCARBONS

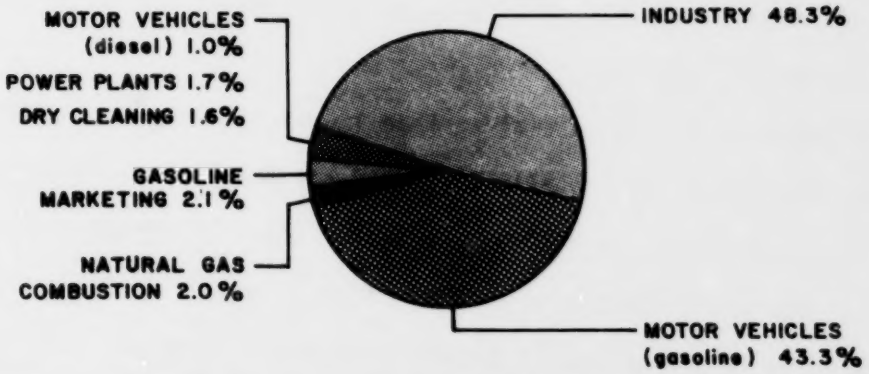
| MONTH | ARITHMETIC MEAN (ppm) | PERCENTAGE OF TIME INSTRUMENT OPERATIONAL | PERCENT COMPLIANCE WITH REGULATIONS | |
|---|---|---|---|---|
| | | | 1-HR | 24-HR |
| | | EDMU | | |
| January '81 | 2.4 | 91.4 | NO REGULATION | |
| February | 2.1 | 93.6 | | |
| March | 2.1 | 97.3 | | |
| April | 1.9 | 97.1 | | |
| May | 1.8 | 91.3 | | |
| June | 1.8 | 88.2 | | |
| July | 1.9 | 96.4 | | |
| August | 2.2 | 97.0 | | |
| September | 2.3 | 97.4 | | |
| October | 2.4 | 96.4 | | |
| November | 2.7 | 97.2 | | |
| December | 2.6 | 97.3 | | |
| | | EIMU | | |
| January '81 | 3.5 | 91.5 | NO REGULATION | |
| February | 3.3 | 96.6 | | |
| March | 3.1 | 96.4 | | |
| April | 3.1 | 93.6 | | |
| May | 3.8 | 97.2 | | |
| June | 3.2 | 97.2 | | |
| July | 2.4 | 82.1 | | |
| August | 2.3 | 84.0 | | |
| September | 1.4 | 96.8 | | |
| October | 1.9 | 96.6 | | |
| November | 2.3 | 90.3 | | |
| December | 3.4 | 96.5 | | |
| | | ERMU | | |
| January '81 | 3.0 | 96.4 | NO REGULATION | |
| February | 2.7 | 97.0 | | |
| March | 2.7 | 88.4 | | |
| April | 2.4 | 86.5 | | |
| May | 2.3 | 92.9 | | |
| June | 2.4 | 92.6 | | |
| July | 2.3 | 97.0 | | |
| August | 2.6 | 96.1 | | |
| September | 2.3 | 96.3 | | |
| October | 2.3 | 93.1 | | |
| November | 2.5 | 95.4 | | |
| December | 2.5 | 96.9 | | |

# FIGURE 6 - TOTAL HYDROCARBONS

## MONTHLY MEANS




## SOURCE AND EMISSION INVENTORY




RELATIVE CONTRIBUTION OF EACH CATEGORY TO TOTAL HYDROCARBON EMISSIONS IN THE EDMONTON AREA, 1973

HYDROCARBONS 39,019 TONS

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G. PARTICULATES

Particulate matter is composed of a wide variety of substances and encompasses any matter dispersed in the air where the individual particles are smaller in diameter than 500 microns (μ). It is the most commonly perceived form of pollution, often manifesting itself by interference with visibility, a soiling effect on materials or as a respiratory irritant. The characteristics of particles and particle dispersion are shown in Figure 7.

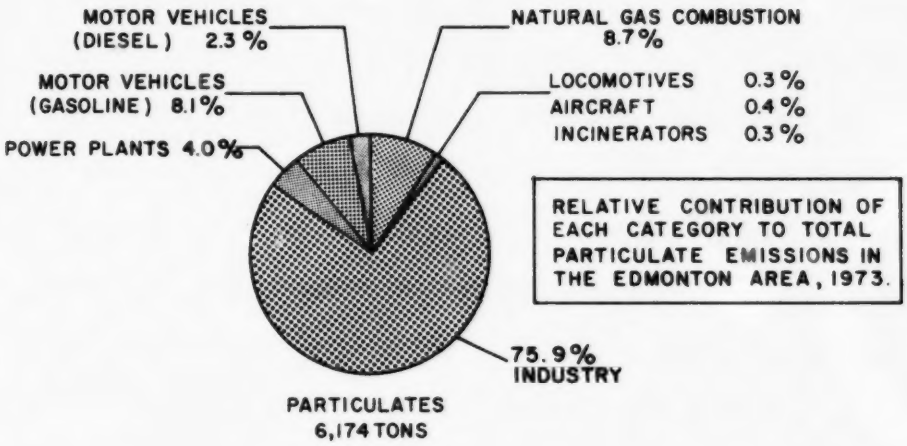
The "Source and Emission Inventory" (Figure 7) indicates that industry is the primary source of particulate emissions. Dust from sources such as wind erosion and construction activities is not included in this inventory, although it may in fact be the greatest overall source.

In the Edmonton metropolitan area, three types of sampling units are employed to measure particulate matter; therefore, the results for each type will be discussed separately in subsequent sections. The three types of samplers are the tape sampler, the high-volume sampler and the dustfall cylinder. The first two samplers measure suspended particulate matter while the latter measures total dustfall.

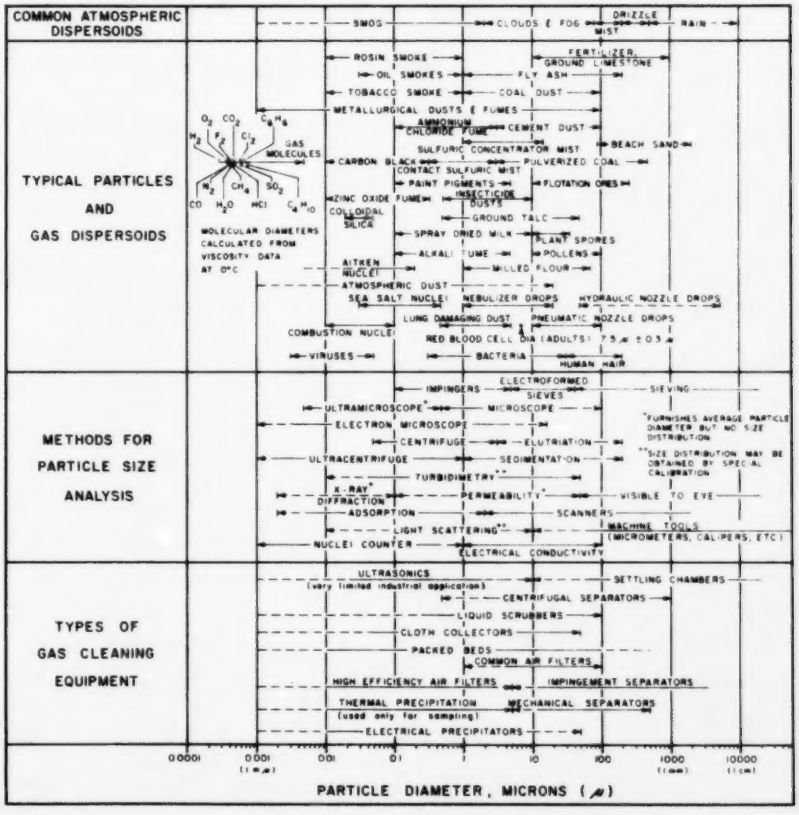
In general, particles smaller than 1 μ in diameter originate in the atmosphere, principally through condensation and combustion. Particles between 1 μ and 10 μ in diameter usually include soil, process dusts and combustion products from industries. Particles larger than 10 μ in diameter generally result from mechanical processes such as wind erosion, grinding, spraying and the pulverizing of materials by vehicles and pedestrians.[4]

# FIGURE 7 - TOTAL PARTICULATES

## SOURCE AND EMISSION INVENTORY


MOTOR VEHICLES (DIESEL) 2.3 %
MOTOR VEHICLES (GASOLINE) 8.1 %
POWER PLANTS 4.0 %
NATURAL GAS COMBUSTION 8.7 %
LOCOMOTIVES 0.3 %
AIRCRAFT 0.4 %
INCINERATORS 0.3 %
75.9 % INDUSTRY
PARTICULATES 6,174 TONS
RELATIVE CONTRIBUTION OF EACH CATEGORY TO TOTAL PARTICULATE EMISSIONS IN THE EDMONTON AREA, 1973.

## CHARACTERISTICS OF PARTICLES AND PARTICLE DISPERSION

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G. 1. SOILING INDEX

Soiling index is the usual index of suspended particulate matter in the size range of 0.1 μ to 10 μ. It is not a measure of absolute concentrations as the method of analysis does not measure the deposited mass.

The types of suspended particulate matter identified as soiling index include smoke and fine dust particles. The samples are collected by drawing sample air through a filter paper over sampling cycles of one or two hours. The soiling properties of the sample are measured by the reduction of light transmission through the filter paper. This reduction is reported as a coefficient of haze (COH) per 1,000 linear feet of air sampled.

The guideline that "a minimum of 90% of readings per month shall be less than 1.0 COH" was complied with by all stations, except at EDMU in December, when the average reading was 2% out of compliance (Table 10). The lowest average levels for the report period were recorded during the spring and winter seasons at EIMU and during the summer at EDMU and ERMU (Figure 8).

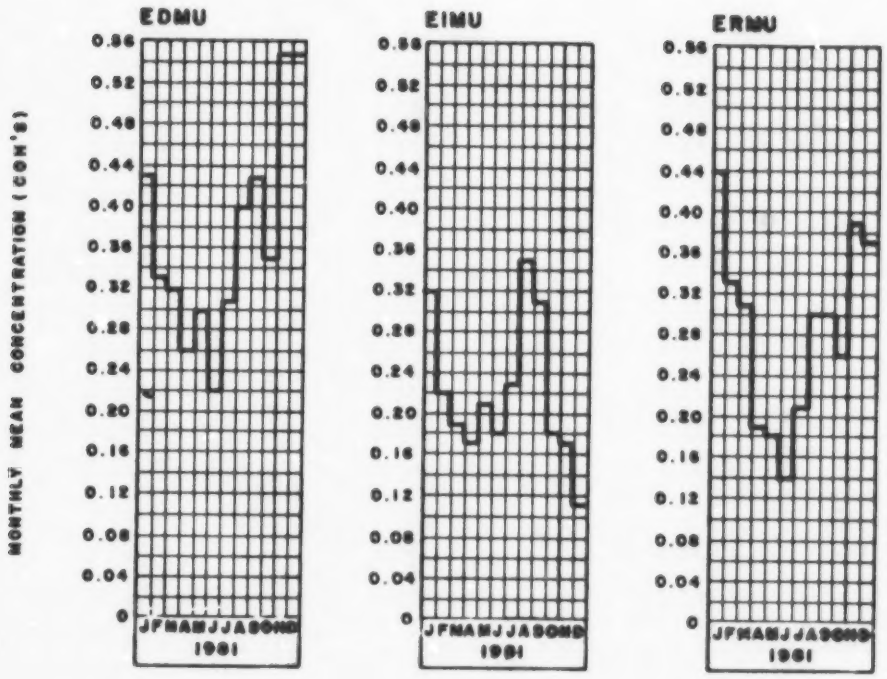
TABLE 10
SUSPENDED PARTICULATE MATTER/SOILING INDEX

GUIDELINE FOR SOILING INDEX
MINIMUM OF 90% OF READINGS PER MONTH
SHALL BE LESS THAN 1.0 COH

| MONTH | ARITHMETIC MEAN (COH) | PERCENTAGE OF TIME INSTRUMENT OPERATIONAL | PERCENT OF READINGS LESS THAN 1.0 COH |
|---|---|---|---|
| | | EDMU | |
| January '81 | 0.43 | 93.8 | 93.7 |
| February | 0.33 | 100 | 98.1 |
| March | 0.32 | 100 | 98.8 |
| April | 0.26 | 100 | 99.0 |
| May | 0.30 | 100 | 98.9 |
| June | 0.22 | 96.9 | 99.7 |
| July | 0.31 | 98.8 | 99.3 |
| August | 0.40 | 100 | 96.5 |
| September | 0.43 | 100 | 94.3 |
| October | 0.35 | 99.6 | 97.0 |
| November | 0.55 | 100 | 90.4 |
| December | 0.55 | 100 | 88.0 |
| | | EIMU | |
| January '81 | 0.32 | 100 | 92.7 |
| February | 0.22 | 100 | 98.4 |
| March | 0.19 | 95.8 | 98.0 |
| April | 0.17 | 97.5 | 99.3 |
| May | 0.21 | 99.7 | 97.2 |
| June | 0.18 | 98.3 | 99.6 |
| July | 0.23 | 91.7 | 97.8 |
| August | 0.35 | 90.6 | 96.4 |
| September | 0.31 | 99.7 | 94.7 |
| October | 0.18 | 98.5 | 99.2 |
| November | 0.17 | 99.6 | 99.7 |
| December | 0.11 | 92.9 | 99.7 |
| | | ERMU | |
| January '81 | 0.44 | 99.7 | 90.6 |
| February | 0.33 | 100 | 94.6 |
| March | 0.31 | 100 | 96.1 |
| April | 0.19 | 99.9 | 98.9 |
| May | 0.18 | 100 | 98.8 |
| June | 0.14 | 100 | 100 |
| July | 0.21 | 96.5 | 99.6 |
| August | 0.30 | 99.9 | 98.3 |
| September | 0.30 | 99.9 | 96.1 |
| October | 0.26 | 99.5 | 96.4 |
| November | 0.39 | 100 | 92.8 |
| December | 0.37 | 98.1 | 93.6 |

# FIGURE 8 – SUSPENDED PARTICULATES: SOILING INDEX

MONTHLY MEANS



G. 2. HIGH-VOLUME SAMPLER

Suspended particulate matter is also measured by the high-volume sampler. The sampler consists of a vacuum system and filter housed in a shelter. Suspended particulate matter in the atmosphere is determined by collecting 24-hour samples on the pre-weighed filter. The filter is then reweighed to determine the mass of the particles collected. This method gives a more accurate measurement of suspended particulate matter than the soiling index monitor.

The size of particles collected by the high-volume sampler range from 0.1 μ to 10 μ.

The levels of suspended particulate matter measured by the high-volume sampler (Table 11 and Figure 9) were occasionally in excess of the Clean Air (Maximum Levels) Regulation of 100 $\mu g/m^3$/24-hour at all three stations. No consistent seasonal pattern was apparent; however, average levels were generally lowest during the winter.

There was an average of 71.4% compliance achieved with the Regulation for suspended particulate matter, averaged for all three monitoring stations over the report year. Blowing dust from roads, surrounding fields, construction sites, gardens, etc. are sources which could have contributed to the periods of non-compliance.

TABLE 11
SUSPENDED PARTICULATE MATTER/HIGH-VOLUME SAMPLER

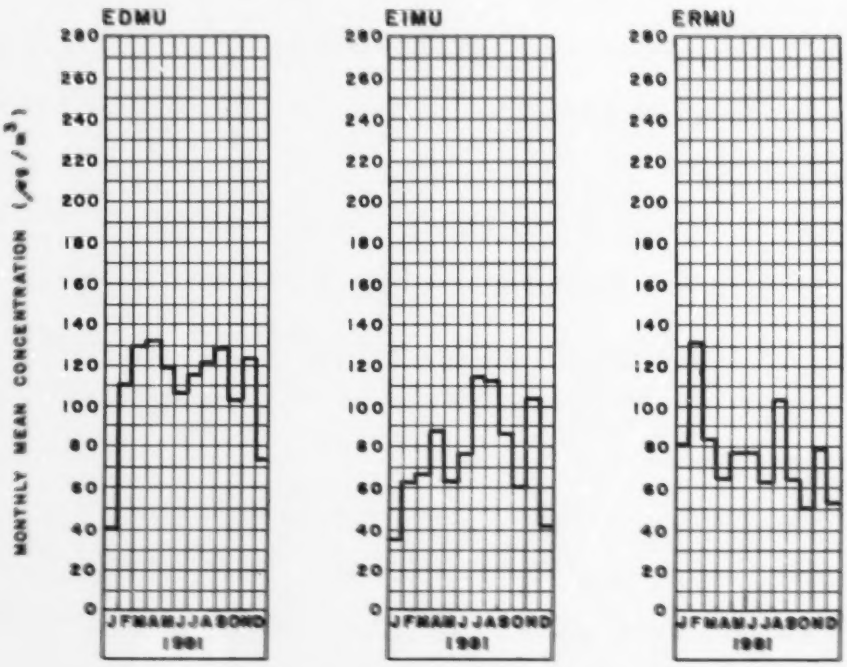
MAXIMUM LEVELS REGULATIONS
24-HOUR-100 $\mu g/m^3$

| MONTH | ARITHMETIC MEAN ($\mu g/m^3$) | PERCENTAGE OF TIME INSTRUMENT OPERATIONAL | PERCENT COMPLIANCE WITH REGULATION |
|---|---|---|---|
| | | EDMU | |
| January '81 | 42[a] | 60 | 100 |
| February | 111 | 80 | 25 |
| March | 131 | 100 | 40 |
| April | 134 | 100 | 20 |
| May | 120 | 100 | 40 |
| June | 107 | 100 | 40 |
| July | 117 | 100 | 40 |
| August | 122 | 100 | 20 |
| September | 130 | 100 | 40 |
| October | 114[a] | 60 | 60 |
| November | 125 | 100 | 40 |
| December | 75 | 80 | 100 |
| | | EIMU | |
| January '81 | 38 | 80 | 100 |
| February | 64 | 100 | 100 |
| March | 68 | 100 | 80 |
| April | 89 | 100 | 80 |
| May | 64 | 100 | 100 |
| June | 78 | 80 | 100 |
| July | 115 | 100 | 20 |
| August | 114 | 100 | 40 |
| September | 87 | 100 | 60 |
| October | 61[a] | 60 | 100 |
| November | 104 | 100 | 60 |
| December | 43 | 100 | 100 |
| | | ERMU | |
| January '81 | 48 | 80 | 100 |
| February | 68 | 100 | 100 |
| March | 85 | 100 | 60 |
| April | 66 | 100 | 80 |
| May | 78 | 100 | 80 |
| June | 78 | 100 | 80 |
| July | 64 | 100 | 100 |
| August | 104 | 100 | 80 |
| September | 65 | 100 | 100 |
| October | 51[a] | 60 | 100 |
| November | 80 | 100 | 80 |
| December | 54 | 100 | 100 |

a.-Instrument operational less than 75%; monthly mean may not be representative.

# FIGURE 9 - SUSPENDED PARTICULATE MATTER: HIGH-VOLUME SAMPLER

MONTHLY MEANS



G.3. TOTAL DUSTFALL

Total dustfall includes particles in the size range greater than 10 μ. Since these particles have appreciable settling capabilities, they are collected by deposition in a dustfall jar or cylinder. The dustfall cylinders are generally exposed for 30-day periods and yield integrated dustfall values for that period.

The large particles collected by dustfall cylinders settle readily at low velocities. Therefore, total dustfall cylinders provide a measure of dust arising from local sources. Quite often high dustfall levels are attributable to nearby construction or vehicular traffic on a dusty road.

The results of the monitoring of total dustfall during the 1981 report period are presented in Table 12 and Figure 10. The readings are actual measured levels and are not corrected for "normal background levels." The data indicate that the lowest levels were monitored during the winter months.

When the total dustfall levels are compared with the Clean Air (Maximum Levels) Regulations, which distinguish between residential-recreational (53 mg/100 $cm^2$/30 days) and commercial-industrial (158 mg/100 $cm^2$/30 days) areas, a high frequency of readings in excess of the Regulations is noted, particularly in the residential-recreational areas.

There were averages of 48.3% compliance and 71.6% compliance respectively with the residential/recreational area and the commercial/industrial area total dustfall Regulations. Blowing dust from roads, surrounding fields, construction sites, gardens, etc. are sources which could have contributed to the periods of non-compliance.

TABLE 12

TOTAL DUSTFALL

MAXIMUM LEVELS REGULATIONS
53 mg/100 $cm^2$/30 days in residential and recreational areas.
158 mg/100 $cm^2$/30 days in commercial and industrial areas.

RESIDENTIAL AND RECREATIONAL AREA STATIONS

| MONTH | ARITHMETIC MEAN (mg/100 $cm^2$ /30 days) | PERCENTAGE OF STATIONS REPORTING DATA | PERCENTAGE OF STATIONS IN COMPLIANCE WITH REGULATION |
|---|---|---|---|
| January '81 | 26 | 100 | 100 |
| February | 33 | 100 | 87 |
| March | 78 | 100 | 33 |
| April | 80 | 87 | 23 |
| May | 120 | 87 | 0 |
| June | 93 | 87 | 15 |
| July | 80 | 100 | 27 |
| August | 58 | 100 | 40 |
| September | 46 | 100 | 80 |
| October | 115 | 100 | 13 |
| November | 56 | 100 | 53 |
| December | 39 | 100 | 93 |

COMMERCIAL AND INDUSTRIAL AREA STATIONS

| | | | |
|---|---|---|---|
| January '81 | 36 | 100 | 100 |
| February | 86 | 89 | 88 |
| March | 172 | 100 | 67 |
| April | 174 | 78 | 57 |
| May | 186 | 100 | 56 |
| June | 177 | 100 | 67 |
| July | 142 | 100 | 56 |
| August | 99 | 89 | 87 |
| September | 124 | 78 | 57 |
| October | 173 | 100 | 56 |
| November | 267 | 100 | 67 |
| December | 52 | 100 | 100 |

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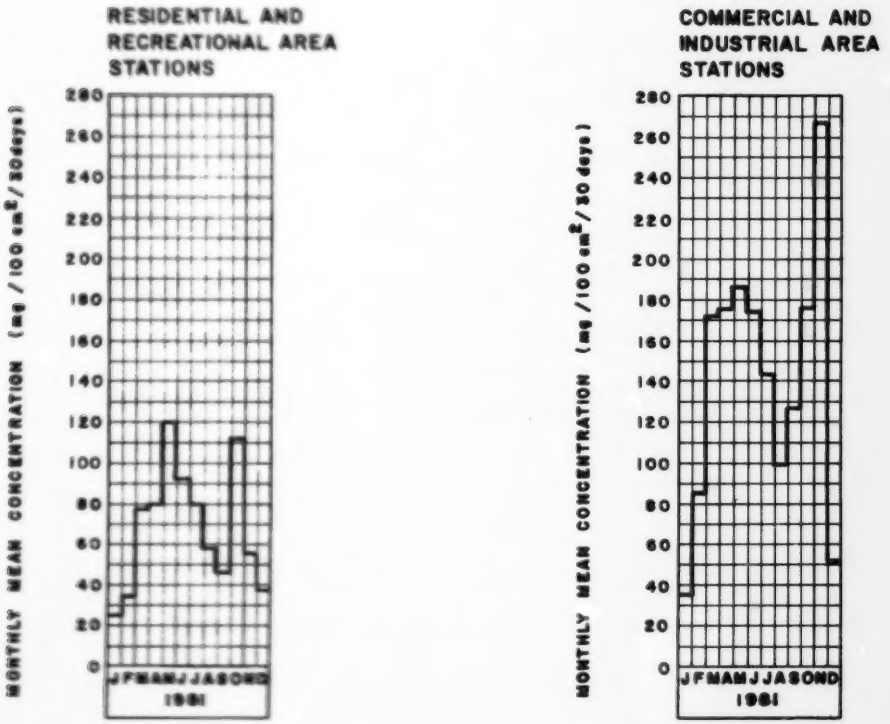
# FIGURE 10 - TOTAL DUSTFALL

MONTHLY MEANS

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## V. METEOROLOGICAL DATA

Air pollution levels depend upon atmospheric stability and wind. Stable air near the ground is modified by the input of heat from the city and heat from the sun. Pollutants tend to become uniformly distributed in this modified region which is called the "mixing layer". The height of the mixing layer and the mean wind speed determine the "ventilation", which may be viewed as the effectiveness of pollutant dispersal with respect to urban area sources. Poor ventilation, known also as "stagnation", leads to an increase in pollutant concentrations. Good ventilation will keep the concentrations low.

During the night, the surface of the earth loses heat to space and cools the air immediately above it, forming the nocturnal radiation inversion layer in which the temperature increases with height. The height of this inversion and its intensity control the development of the mixing layer.

To measure these important parameters, wind and temperature soundings were made at a rural station to the south of the city. The data for 1981 are summarized in Table 13.

As compared with 1980, the spring of 1981 had slightly more frequent early morning inversions, but they were shallower and of lesser intensity. The fall of 1981 had a similar frequency of early morning inversions, as compared with 1980, and as with the spring, they were shallower and less intense in 1981. As compared with 1980, midday mixing heights were slightly lower in the spring of 1981 but were similar in the summer and fall. Afternoon mixing

heights in the spring of 1981 were similar to those of 1980, but in the fall of 1981 they were considerably larger than in the fall of 1980. In summary, it appears that the meteorological air pollution potential in 1981 was somewhat lower than it was in 1980.

TABLE 13

SUMMARY OF LOWER ATMOSPHERE SOUNDINGS
ALBERTA ENVIRONMENT
ELLERSLIE STATION

| Frequencies/Median values | Apr.'81 | Jul.'81 | Oct.'81 |
|---|---|---|---|
| 07:30 MST | | | |
| Days with ground-based inversions | 12 | 1 | 17 |
| Ground-based inversion height (m) | 162 | 54 | 315 |
| Potential temperature gradient (°C/100m) | 1.0 | 1.0 | 2.3 |
| Days with mixing layer | 6 | 17 | 3 |
| Mixing layer height (m) | 126 | 180 | 579 |
| Wind speed in lowest hundred meters (m/s) | 3.9 | 3.2 | 3.8 |
| 09:00 MST | | | |
| Days with ground-based inversions | 1 | 0 | 11 |
| Ground-based inversion height (m) | 108 | - | 438 |
| Potential temperature gradient (°C/100m) | 1.0 | - | 1.7 |
| Days with mixing layer | 17 | 18 | 8 |
| Mixing layer height (m) | 447 | 4.4 | 288 |
| Wind speed in lowest hundred meters (m/s) | 4.5 | 2.8 | 3.6 |
| 12:00 MST | | | |
| Days with ground-based inversions | 0 | 0 | 0 |
| Ground-based inversion height (m) | - | - | - |
| Potential temperature gradient (°C/100 m) | - | - | - |
| Days with mixing layer | 16 | 16 | 18 |
| Mixing layer height (m) | 644 | 957 | 488 |
| Wind speed in lowest hundred meters (m/s) | 4.8 | 2.6 | 3.7 |
| 15:00 MST | | | |
| Days with ground-based inversions | 1 | - | 3 |
| Ground-based inversion height (m) | 36 | - | 72 |
| Potential temperature gradient (°C/100m) | 1.0 | - | 1.1 |
| Days with mixing layer | 12 | - | 13 |
| Mixing layer height (m) | 897 | - | 864 |
| Wind speed in lowest hundred meters (m/s) | 5.5 | - | 3.2 |

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## VI. INDEX OF THE QUALITY OF THE AIR (IQUA)

The IQUA is an indicator of the status of existing air quality. It is based on the 1-hour and 24-hour concentrations of nitrogen dioxide, sulphur dioxide, and soiling index (COH), on the 1-hour and 8-hour concentrations of carbon monoxide, and on the 1-hour concentrations of ozone. An index is calculated for each of the five pollutants. The maximum index is then used as the numerical value of IQUA. An IQUA reading of 0-25 indicates good air quality, 26-50 is fair, 51-100 is poor and greater than 100 is very poor.

In Edmonton, the IQUA is calculated at three locations: EDMU, ERMU and EIMU, with the index made available to the media and public routinely. It is generally issued at 0800 and 1500 hours on weekdays, except when the index values are greater than 50. In the latter case, it is generally issued every hour until the index value falls below 50.

A summary of the air quality indices for the three monitoring stations is presented in Table 14. During the report year, the air quality was generally good (0-25 as an arithmetic mean). On occasion, however, index values in the poor and very poor categories were observed. Such values were usually a result of high soiling index levels.

TABLE 14

INDEX OF THE QUALITY OF THE AIR (IQUA)

| | EDMU | EIMU | ERMU |
|---|---|---|---|
| MONTH | ARITHMETIC MEAN | ARITHMETIC MEAN | ARITHMETIC MEAN |
| January '81 | 27 | 21 | 24 |
| February | 24 | 16 | 22 |
| March | 22 | 17 | 21 |
| April | 18 | 16 | 16 |
| May | 17 | 20 | 18 |
| June | 15 | 16 | 15 |
| July | 20 | 17 | 18 |
| August | 25 | 23 | 23 |
| September | 25 | 19 | 18 |
| October | 20 | 12 | 16 |
| November | 28 | 12 | 21 |
| December | 29 | 13 | 22 |

Alberta
ENVIRONMENT
Pollution Control Division
Air Quality Control Branch

## VII. SUMMARY AND CONCLUSIONS

From the foregoing analysis of the data, the following can be concluded:

1. During the report year, the air quality index in the Edmonton area was generally in the "good" range (0-25 as an arithmetic mean).
2. All nitrogen dioxide readings were 100% in compliance with the Regulations, with the exception of 99.8% compliance in January with the 1-hour Regulation at EDMU. Vehicular traffic exhaust is responsible for the small amount of non-compliance time.
3. High natural background ozone levels in Alberta resulted in a significant number of readings in excess of the 24-hour ozone Regulation. There was an average of 75.9% compliance with the 24-hour ozone Regulation for all three monitoring stations for the report year. Good compliance was achieved with the 1-hour ozone Regulation (average of 99.8% compliance for all three monitoring stations for the report year).
4. There were averages of 99.8% compliance and 97.0% compliance respectively with the 1-hour and the 8-hour carbon monoxide Regulations, averaged for all three monitoring stations for the report year. Vehicular traffic exhaust is responsible for the small amount of non-compliance time.
5. All sulphur dioxide readings were well below the Regulations, resulting in 100% compliance.

6. All soiling index (coefficient of haze-COH) readings were 100% in compliance with the Alberta guideline, with the exception of December at EDMU, when the average reading was 2% out of compliance.

7. There was an average of 71.4% compliance achieved with the Regulation for suspended particulate matter (0.1 μ to 10 μ size range), averaged for all three monitoring stations over the report year. Blowing dust from roads, surrounding fields, construction sites, gardens, etc. are sources which could have contributed to the periods of non-compliance.

8. There were averages of 48.3% compliance and 71.6% compliance respectively with the residential/recreational area and the commercial/industrial area total dustfall (greater than 10 μ size) Regulations. Blowing dust from roads, surrounding fields, construction sites, gardens, etc. are sources which could have contributed to the periods of non-compliance.

## VIII. REFERENCES

1. U.S. Department of Health, Education, and Welfare. Air Quality Criteria for Nitrogen Oxides. (NAPCA Publication No. AP-84. Washington, D.C., January 1971); sec. 11, p. 8.

2. Alberta Environment, Research Secretariat. A Study of Photochemical Air Pollutants in the Urban Airsheds of Edmonton and Calgary, by H.S. Sandhu. (Staff Report #1. Edmonton, Alberta, 1975).

3. Alberta Environment. Industrial Sulphur Emissions for Alberta 1977-1981, prepared by Alberta Environment, Pollution Control Division, Air Quality Control Branch. September 1982.

4. U.S. Department of Health, Education, and Welfare. Air Quality Criteria for Particulate Matter. (NAPCA Publication No. AP-49. Washington, D.C., January 1969); p. 181.